of the steel strip 1. Next, through the inside of steel strip 1, the electric current flows to the positive charged part between the cathodes 24, and then, through the neutral salt solution film 32 and the jet streams 31 of the cathodes, the electric current returns to the power supply 25 through suitable wiring to provide a closed series circuit independent of the bath.

In the conventional electrolysis, because the anodes 23 and the cathodes 24 were arranged immersed in the neutral salt solution 20 the short-circuit current flowed between the anodes 23 and the cathodes 24 through the bath of the neutral salt solution 20 to result in a lot of loss of the electric current. Compared with the conventional electrolysis, however, in this invention the short-circuit current between the anodes 23 and the cathodes 24 decreases very much, since the route of short-circuit current is limited to only the film 32, and the electric power efficiency improves.

The positive charged part of the steel strip 1 between the cathodes 24 locally becomes an anode 33, and on the anode 33 chrome oxide in the oxide film ionizes according to the chemical reaction (1) and dissolves in the neutral salt solution 20.

$$Cr_2O_3 + 4H_2O \rightarrow Cr_2O_7^{2-} + 8H^+ + 6E \quad (1)$$

The oxide chrome ions dissolved in the neutral salt solution 20 fall in the electrolyte tank 21 and the chrome oxide is eliminated from the surface of the steel strip 1.

On the surface of steel strip 1 between the anodes 23, chrome oxide separates out according to the adverse chemical reaction to the reaction (1). The arrangement of the anodes 23 to the upper stream side and the cathodes 24 to the downstream side respectively, prevents from separating out again by the reduction similar to the conventional electrolysis.

As there are a lot of anodes 23 and cathodes 24, the electric current to the steel strip 1 is large. Therefore, a lot of anodes 23 and cathodes 24 increase the electric current density in the steel strip 1 and thereby improve the descaling speed. In this example, since we increased the number of cathodes 24 in order to improve the descaling speed, the anode 33 provided the electric current density enough to properly descale.

Because the neutral salt solution 20 contacts conductor 29 immediately surrounding in jet opening 26, we supply the large electric current to the steel strip 1 constantly through the jetstreams 31 of the salt solution 20 without interruption. Therefore, as the electric current density of the steel strip 1 is large, we can descale rapidly and uniformly.

Likewise with the neutral salt solution electrolytic part 6, in the alkali solution electrolysis part 8 and the nitrate solution electrolytic part 10, descaling is performed

by jetting the electrolyte and electrolysis with the anodes 23 and the cathodes 24.

Table 1 shows the total electrolyte quantity, the total electric energy and the maximum line speed of the example 1, compared with the conventional electrolysis submerging steel strip.

Table 1

	Conventional	Present Invention
total electrolyte quantity(neutral salt + nitrate)	1	0.3
total electric energy	1	0.4
maximum line speed	1	1.5

The total electrolyte quantity is about 30 % and the total electric energy is 40 % or less of the conventional electrolysis. The maximum line speed improves 50 % in comparison with conventional electrolysis. Jetting has an effect of peeling off the scale and contributes to the improvement of the line speed.

(Example 2)

The steel strip manufacturing apparatus according to the second example of the present invention is explained with respect to Fig. 4A to Fig. 4D, wherein steel strip is an annealed normal steel with mainly Fe_2O_3 and Fe_3O_4 formed on the surface.